

BEWARE OF SKYNET —

Computer power is growing at incredible speed, doubling approximately every two years.

Scientists are predicting a technological explosion with unforeseen impact. Are we prepared for the computer revolution?

TILL DALDRUP (TEXT)

WELCOME TO THE SURPRISE PARTY

Computer power is growing at exponential speed — but what does that really mean? To understand this, imagine a chessboard. Put a grain of rice on the first square. Put two on the second, four on the third. Keep doubling the amount with every square. How much rice is on the board when you reach the 64th and last square? Well, it sure will not fit on a chessboard: The amount would outstrip global annual rice production approximately 1,000 times over. In fact, it would probably be enough to cover the whole world in a several inch-deep layer of rice grains. Surprised?

The same thing has basically happened to computer power over the past fifty years: It has doubled approximately every two years, as chips become smaller and are packed with twice the amount of transistors. This process is called Moore's law, named after Intel Co-Founder Gordon E. Moore. Moore predicted this development in the 60s, first saying the amount of transistors on chips would double every year, later revising his prediction to a two-year cycle.

This progress brought us from room-filling machines to high-tech computers in our pockets, from bulky telephone systems to ultra-fast data transport on the Internet. The future outcomes of this exponential growth are nearly unforeseeable: Since we humans have mostly dealt

with linear developments throughout our evolution as a species, we have a hard time processing this exponential progress — and we might be surprised where it leads us.

But Moore's law is not a natural principle like Newton's laws of motion. It is merely an observation of a technological development. So is this progress really going to go on forever? Scientists are split over that question: Moore himself predicted in 1995 that technological growth would start to decelerate within ten years, a prognosis that turned out to be incorrect. Now he forecasts that the end of his law would come in 2025. And this time he could be right.

The growth of computer power has slowed down a little bit recently: As it gets more and more expensive to double the amount of transistors on a chip, they might also reach a physical limit. A transistor nowadays is 14 nanometers small, 500 times tinier than a red blood cell. If you shrink them further, to the size of just a few atoms, the physics of electrons working in them might not function anymore.

But recent developments have raised hopes that other techniques might replace the "traditional" way of building computer chips. That is why Martin Ford, computer engineer and robotics expert, thinks that Moore's law is going to con-

tinue in the long run, even if the growth rate might deteriorate. "There are other options on the table, for example making three-dimensional chips, where we are stacking transistors on top of each other," Ford says. Another possible alternative is quantum computing, a technology which promises to accelerate computers nearly infinitely. It is still unclear if these techniques are going to be the big break the industry wishes them to be. But the potential is immense.

Some even think that this development might lead to something called singularity, a point of no return in tech growth. Supporters of this hypothesis believe that from that moment on, computers could improve themselves or build even smarter machines. Soon they could far exceed human intelligence.

Society would radically change: Machines could become overlords or super-intelligent helpers. "I think more and more of our society and economy will be run by

artificial intelligence, by algorithms," says Ford. "Hopefully there will be an important role for people, and they will be in control."

So when are we going to see this explosion of technological development? No one can be sure. Predictions range from 30 to 100 years. Some say it is never going to happen. But that is the thing with exponential developments: Few people expect them until they are already there. ♦

GORDON E. MOORE

Moore is the Co-Founder of semiconductor giant Intel. In the tech world, he is hailed for his predictions regarding the growth of computer power, also known as "Moore's law". From 1979 on he was the CEO of Intel, before becoming Chairman of the Board in 1987. He retired ten years later and turned to philanthropy, establishing the Gordon and Betty Moore Foundation.

WHAT WILL HAPPEN TO THE GROWTH OF COMPUTING POWER?

Will growth of computer power slow down as doubling the amount of transistors on a chip gets more expensive? Or will other technologies replace "traditional" computer chips?

Growth of computing power by calculations per second per USD 1,000

Source: humansworld.wordpress.com (until 2045, after that: own estimates)

